sion. Only an insignificant addition to the estimate of 7000 years can therefore be required by the diversion of the waters of the upper lakes.

The view held by Taylor, Spencer, and Lawson, that the high shore lines around the great Laurentian lakes are of marine formation, seems to be inconsistent with the total absence of marine fossiliferous beds overlying the glacial drift in all that region. So far as the sea did extend, after the further recession of the ice-sheet permitted it to come into the St. Lawrence and Ottawa valleys and into the basin of lake Champlain, marine fossils abound; but none are found above the Thousand Islands at the mouth of lake Ontario. We may therefore confidently accept the Niagara gorge as a measure of all the time since the departure of the ice-sheet from the northern United States.

In a recent paper in the *Journal of Geology* (vol. ii. p. 142, February–March, 1894) Mr. Andrew M. Hansen, of Norway, notes the approximate concurrence of about thirty independent measurements and estimates of the duration of the Post-glacial period, which have been made in North America and in Europe, all coming within the limits of 5000 and 12,000 years. He accordingly says: "With full regard to a legitimate calculation of probabilities, it may be predicated that the number of 7000 to 10,000 years is as nearly an exact estimate of the duration of Post-glacial time as can ever be expected."

Minneapolis, Minn., June 9. Warren Upham.

The Teeth and Civilisation.

None of the writers of the interesting letters which have appeared upon this subject seem to have kept before them a distinction which is of the utmost importance in its investigation, and which I should like to state, in order that the attention of those who, like Mr. Wenyon, have opportunities of observation of any segregated community, may be drawn to it.

Dental caries is very prevalent, and its increase seems to be very rapid, so that the last few generations show a marked increase; at least so it is generally believed.

But its victims may be divided into two groups, namely, those whose teeth are apparently perfect in their construction, but nevertheless fall a prey to caries, and those whose teeth show, to the trained eye, clear evidence of structural weakness.

As the latter class present a problem in heredity, and for various reasons are likely to be more interesting to the readers of Nature than the former, I will dismiss these with a very few words.

There is good reason for supposing that the proximate cause is to be found in vitiation of the oral secretions, as caries often occurs in an extreme degree after diseases of the digestive tract, and examples such as those quoted by Mr. Wenyon are probably to be explained as due to dyspepsia induced by the unhealthy way of feeding.

To the explanation that the enamel may be cracked by alternations of temperature which could be borne in the mouth, I am not inclined to attach importance. In the first place, as a matter of experiment, I have failed to crack enamel by plunging teeth alternately into boiling and ice-cold water, and, as a matter of clinical experience, teeth do not decay along the cracks which from some cause are common in the enamel, but in natural pits of larger size, or on surfaces of contact; the cause is to be sought either in decreased power of resistance, or in the intensification of deleterious influences.

Abnormal conditions of life are known to deleteriously affect the teeth of animals; for example, stall-fed beasts are more liable to diseased conditions in the mouth than those which are fed up in rich pastures; and it has been pointed out by Mr. Bland Sutton, that some animals in the Zoological Gardens suffer in this way, notably the Lemurs, whose teeth frequently loosen and fall out.

It is rare to meet with good teeth in children whose parents have had bad teeth, and peculiarities of form in the teeth and jaws are often inherited with curious exactitude. But it is quite common to meet with instances of healthy parents with good teeth bearing a family of children, also apparently healthy and well-grown, whose teeth, although to the casual observer normal in shape, size, and general aspect, are to the eye of the dentist doomed to early destruction, and speedily undergo it.

These teeth have an appearance somewhat difficult to describe; they have a glassy look, are more translucent than they should be, are softer, and are believed, though the proof is not complete, to be somewhat deficient in their proper proportion of lime salts. This kind of tooth is very apt to run through a whole family, and its causes must be sought either in some condition of inheritance, or if it be due to anything acting upon the individual, it must be something which commences to act immediately after birth. Comparative anatomy teaches us that the teeth are less variable than the jaws. In long-muzzled dogs the teeth are spaced; in short-muzzled dogs they are crowded, reduction in size having gone on faster in the bones than in the teeth; and the same thing is observed in the human subject.

Moreover in animals, whilst some variability is often observable in the teeth, that variability does not take the form of structural difference, but only of differences of size and shape.

Again, in rickets, where the bones are starved of lime salts, the teeth contrive to get more than their share; it is therefore not a little remarkable that we should find the teeth, and apparently the teeth alone, to have deteriorated in one generation.

On the other hand, it is equally difficult to find any cause which shall have operated alike upon all the children of a family if we reject inheritance as being at the bottom of it; it does not appear to be determined by the greater frequency of hand-feeding, as I know of instances in the same family where some children were nursed and others were not, and yet their teeth were alike of the poor structure to which I have alluded.

Upon the whole, I am rather inclined to attribute it to some causes operating shortly after birth, rather than before it, for the milk teeth, which are well started in utero, are far less liable to structural variation than are the permanent teeth, whose calcification is mainly effected after birth; but I need hardly say that the period of occurrence does not by any means exclude inheritance.

However the question, interesting and important as it is, is not so simple as some of your correspondents imagine, and there is a considerable amount of literature upon the subject which seems to have escaped them, some of it accurate and valuable, some of it quite the reverse.

Charles S. Tomes.

Electrical Theory of Vision.

In my letter to Prof. Lodge, published in your last issue, I notice a printer's error, which I think should be corrected, as it gives an entirely wrong meaning to the sentence in which it occurs. As it stands it reads as follows: "The energy thus lost by the tissues was then *suppressed* from without by the vibrating fingers," whereas I said the energy was *supplied* from without by the fingers, the idea being that the shaking back of the eyes to their normal state of rest, evinced by the sensation of darkness, is perfectly analogous to the tapping back of Prof. Lodge's "Coherer" to its normal position, evinced by the return of the galvanometer needle to zero.

E. Obach.

Old Charlton, Kent, June 23.

CLIMBING AND EXPLORATION IN THE KARAKORAM-HIMALAYAS.[1]

The mountain district explored by Mr. Conway lies on the southern side of the watershed of the Karakoram chain, and is drained by tributaries of the Upper Indus. For most of the time he was in Baltistan, but ended his journey by a visit to Leh. Here, at about 11,500 feet above sea-level, is a small meteorological observatory, which enabled Mr. Conway to check his observations by a comparison of barometers. Besides himself, the party consisted of the Hon. C. G. Bruce, Mr. McCormick, the artist, Messrs. Eckenstein and Roudebush, Matthias Zurbriggen, the well-known guide from Macugna, four Gurkas, who took readily to ice work, and one or two two other native attendants, with, of course, a considerable but variable party of coolies.

As the author states, the party spent in all eighty-four days on snow or glacier. They were often encamped at elevations ranging from 12,000 to 15,000 feet above the sea, occasionally even up to 20,000 feet, and some of them accomplished the ascent of a peak approximately 23,000 feet—the highest summit which man has reached. But mountain climbing was far from the only purpose of the expedition. Mr. Conway surveyed the district, and has made many important additions to and corrections in the map which was constructed, about thirty years ago, by Colonel Godwin-Austen, after a journey—for that time—hardly less adventurous. He got together considerable collections, and noted, with the eye of an expert, the archæology and other peculiarities of this remote region. A supplementary volume, to be issued in the course of a few months, will contain reports on the zoology, botany, and geology, and on the other scientific results of the expedition. The separation of the two parts is to be regretted, but was probably almost inevitable.

---

[1] "Climbing and Exploration in the Karakoram-Himalayas." By William Martin Conway, M.A., F.S.A., &c. With 300 Illustrations by A. P. McCormick, and a Map. (London: T. Fisher Unwin, 1894.)

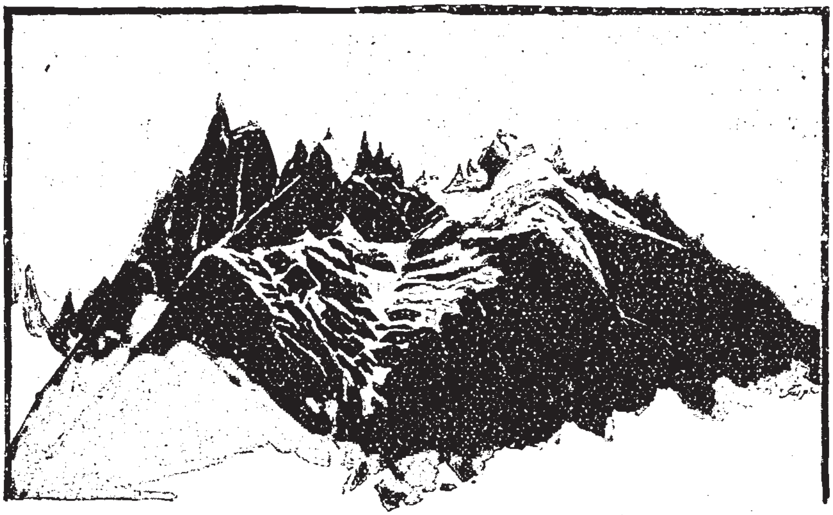

Fig. 1.—The Ogre's Fingers, Biafo Glacier.

Incidentally, however, Mr. Conway tells us something of the natural history and geology of the mountain regions, and a note on the latter subject has been communicated recently to the Royal Society. This part of the Karakoram-Himalayas evidently consists of strips of sedimentary rocks infolded in crystalline masses, and often resembles the Alps of Europe not only in structure but also in mineral characters. Many of its glaciers are enormous; for instance, one proved to be forty miles in length; others are hardly less; their ice-falls sometimes are even more formidable than those in the Alps. This Mr. Conway attributes not so much to their greater steepness of slope as to the irregular form of their beds. They lie among peaks which often range from about 22,000 to 26,000 feet above sea-level, and in one case—the nameless K2—reach 28,278 feet. The snow-line, however, is much higher than in Central Europe. In the middle of April, at the beginning of his journey, Mr. Conway found the snow lying thickly below 13,000 feet, but later in the season an elevation of 15,500 feet in his district seems to correspond roughly with that of 8000 feet in the Alps. But in this respect, evidently, there is considerable variation; for the "col" between the vast Hispar and Biafo glaciers is only 17,600 feet above the sea, while further to the east, passes on the route from Yarkand to Leh rise to this height, or even more, and are almost free from permanent snow.

The first-named pass entailed the longest march over glacier and snow, for it occupied the explorers from July 11 to July 26; but the greatest height above sea-level was reached at the head of the Baltoro glacier. Here, on the flank of a huge mountain, called the Golden Throne, the party encamped for five nights at stations from 18,200 to 20,000 feet above sea-level, Mr. Conway sleeping two nights at the latter elevation, and he ascended, in company with Mr. Bruce, one of its peaks (Fig. 2). This, according to a barometric observation, is 22,600 feet in height, but by its level compared with K2 it should be not less than 23,000. On several occasions they reached elevations ranging from 17,000 to over 19,000 feet, and frequently camped out above the level of Mont Blanc. Thus they had exceptionally good opportunities of observing the effects of diminished atmospheric pressure. Their experience fully bears out that of Mr. Whymper in the Andes, though it affords some interesting differences in detail, while the effect produced, as usual, depended much upon the individual; it also seemed to vary with the environment. Occasionally the attendants suffered at from 13,000 to 14,000 ft., but, as a rule, the Europeans and stronger members of the party were not materially affected till about 15,000 feet, and then but slightly, unless they spent the night on the spot. This, it will be remembered, accords with Prof. Tyndall's experience on Mount Blanc. The usual symptoms were felt: panting for breath, and quick, irregular action of the heart after the slightest exertion, with headache, more or less nausea, and a general sense of extreme lassitude and exhaustion. The

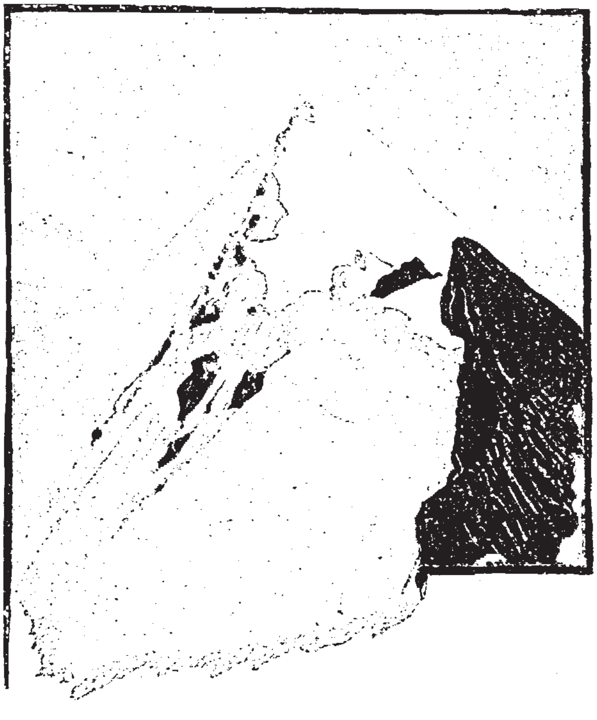

Fig. 2.—Pioneer Peak (Golden Throne) from about 20,700 feet.

travellers were most severely affected at the highest camp on Golden Throne, though even here, when completely at rest, the inconvenience was comparatively slight. The ascent from this camp—probably about 3000 feet, without any exceptional difficulties—took $8\frac{3}{4}$ hours. In such a district as the Pennine Alps this distance would probably have been accomplished in half the time. It is therefore obvious that the difficulties in reaching such a point as K2 will be extremely great, though possibly not insuperable. Among these the weather will be one of the most serious. This, in the Alps, is frequently not good; in Baltistan, unless Mr. Conway's experience was exceptional, it is habitually abominable.

Much interesting information in regard to physical geology can be gleaned from this volume. The beautiful illustrations enable us to form a good idea of the magnificent snow peaks; the lower mountains, as a rule, seem to be more precipitous and shattered, more weird and desolate than in the Alps (Fig. 1). The climatal conditions are probably favourable to rapid denudation; mud avalanches are frequent, sometimes on a gigantic scale; the fans of débris also are enormous. Mr. Conway's account of the alluvial deposits in the beds of the valleys, especially on the route to Leh, are most interesting (Fig. 3). These often make it difficult to discover the limits to what glaciers have extended. At the present day the larger ice-streams seem to end at 10,000 to 11,000 feet above sea-level, but here, as in other mountain regions, they were once much greater. Mr. Conway mentions the occurrence of old moraines at various elevations down to about 6000 feet, and we cannot be certain that this is the lowest limit.

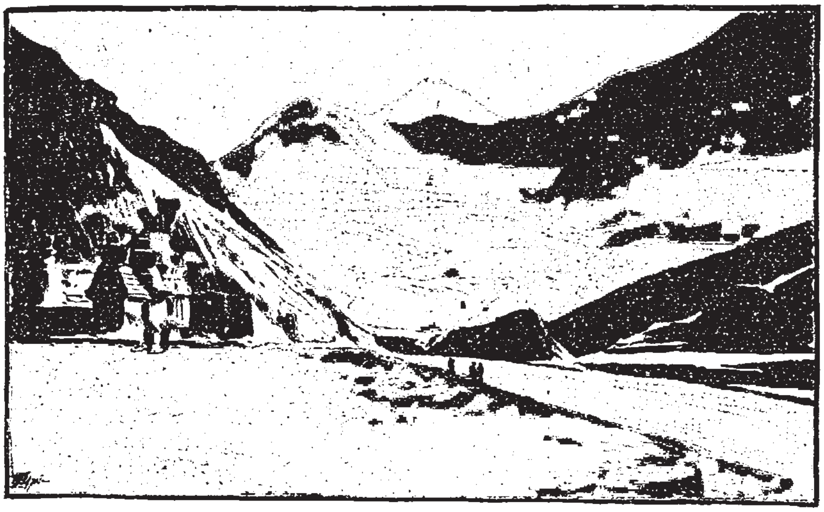

FIG. 3.—Remains of Alluvium, Lama-yuru Valley

The volume contains, in addition to a map, three hundred illustrations, process-block reproductions of drawings by Mr. McCormick, some from photographs, and some from original sketches. They represent not only the scenery, but also incidents of travel, and greatly enhance the value of the book. It is worthy to take a place, for literary and artistic excellence, with Mr. Whymper's "Travels amongst the Great Andes of Ecuador," for it is a record of an adventurous journey, carefully planned and bravely effected, as well as a real contribution to knowledge. Clearly and pleasantly written, full of interesting information, not only on the geography, geology, and natural history, but also on the people, buildings, and customs of a rarely visited region, the book does honour to its genial and able author and to his companions in travel.

A NEW FORM OF OBJECT-GLASS MOUNTING.

AMONG the numerous details in telescopic construction that have become of greater importance in consequence of the increase in size of refractors, may be mentioned that relating to the form of mounting of the object-glass, which plays a leading *rôle* in the good working of a telescope.

The chief difficulty which has to be overcome is the great dearth of substances which have the same coefficient of expansion as glass. For small objectives brass fastenings are used, but for larger discs these have been replaced by the adoption of steel, the coefficient of expansion of which more nearly approaches that of glass. In the latter case allowances have to be made for the difference of expansions of the two substances (glass and steel), and this is done by breaking the metallic band which encircles the objective, and connecting the two ends thus freed by means of one or more screws. In this way the pressure of the band on the circumference of the discs can be regulated by tightening or slackening the screws as the case may be, and the inequality of expansion or contraction can thus be counterbalanced.

If only one disc of glass were in question, the problem would be somewhat simple, but since an objective consists of two discs, and these of different kinds, each possessing its own special coefficient of expansion, the matter is distinctly complicated. With two discs it will be seen at once that the metallic ring may be made fast for one, while the other can be free to move, and therefore quite loose; this naturally raises numerous disturbances in the centering of the lenses.

The functions of a perfect cell are then, firstly, it must be capable of holding the lens firmly and without change of form; while, secondly, it must be so arranged as to allow for the different changes brought about by temperature without disturbing the centering of the lenses.

To produce such a cell as this has been the object of Dr. R. Steinheil's investigations[1] and the following summary contains his suggestions. The principle consists in leaving a space between the inside of the cell and the circumference of the two lenses, and placing rigidly between them blocks of particular substances and sizes, such that they compensate for the different expansions at work.

The amount a substance expands or contracts depends not only on its increase or decrease in temperature, but on its length; thus, for instance, a long rod when heated expands more than a short rod of the same substance. Making use of this fact, we may either assume the *length* of the blocks referred to above, and calculate of what substances it must be composed to give the exact coefficient of expansion required, or we may take any substance with a *known* coefficient of expansion, such as zinc, and determine the length it is required to be. The latter method, of course, by its simplicity commends itself, and if the length of the block be denoted by l we have the formula

$$l = \frac{\phi - \gamma}{\sigma - \phi'},$$

---

[1] See "Ueber eine neue Art von Objektivfassungen" in *Zeitschrift für Instrumentenkunde*, Heft 5, p. 170, 1894.